ALLOCHTONOUS FACIES OF IMPACTITES AND IMPACT BRECCIA OF THE POPIGAI CRATER, RUSSIA. V.L. Masaitis and M.V. Naumov. Karpinsky Geological Research Institute, 199106 Sredny pr. 74, St.Petersburg, Russia, Victor_Masaitis@vsegei.ru

Introduction. It is a long time since impact cratering was considered as a geologic process [1], and it is obvious that exploration of impact-generated rocks should follow general principles and methods adopted in lithology and petrography for main types of crust-forming rocks, including principles of systematics, classification, and nomenclature [2, 3, 4]. The analysis of rock facies represents one of these methods, commonly used under study of sedimentary, igneous and metamorphic rocks and their geologic bodies, along distinguishing, correlation and mapping of certain rock units. At present, the facies analysis of impact-generated and impact-related rocks is not well elaborated as well as nomenclature and classification of facies. Many principal data concerning certain mechanisms of impact cratering and accompanying rock-forming processes might be obtained by analysis of facies in detail.

The concept of facies involves the idea of lithological or petrographic features of certain rock or rock assemblage as well as idea of corresponding geologic setting of their formation [5]. Analysis of impact facies before now is not systematically used, thought some proposals of this kind were introduced before [6, 7, 8].

Impact-generated facies in the Popigai crater. The whole allochtonous impact-generated rock assemblage found inside and outside the 100 km Popigai impact crater, Northern Siberia [9] may be regarded as a series of impact facies (megalithotype), i.e. a synchronous continuum of facies formed during the single impact event. In contrary of the sedimentary and most of volcanic facies, the facies of impact-generated rocks occurring one above another in the vertical section do not reflect, in general, any succession of their formation in geological time, and do not reflect a certain duration of this process in a common geological sense.

Facies of first order (macrolithotypes) are: (1) impact lithic breccia, subdivided into several groups by size fragments and occasional admixture of small amount of impact glass, and (2) impactites, which consist mostly of chilled or crystallized impact melt – either (2a) massive (tagamite) or (2b) fragmental (suevite). Both of impactite lithologies enclosure numerous rock and mineral clasts, partly shocked and melted. All these macrofacies (up to 2 km thick or more) fill in the central crater depression, ring through and occur outside the crater as small patches preserved from erosion.

When a more detailed classification of impact facies being considered, several microlithotypes may be distinguished: (a) air fall fine-grained lithic breccia with suevite lenses; (b) base surge deposits represented by obscure-bedded suevite showing in places cross-bedding; (c) deposits of settled plume and pyroclastic flow composed of enriched of glass shards and bombs suevite, which enclose small tagamite bodies; (d) material transported by crater-forming flowage and transient crater collapse and composed of tagamite supported by crystalline megablocks; (e) ballistic ejecta consisting of thick sheet-like tagamite and various lithic megabreccia partly cemented by suevite.

Both number and sequence of microlithotypes within certain structural segments of the crater are different. In the central depression, the sequence of about 2 km thick is the following, from top to bottom: air-fall facies from impact plume; suevite deposits of settled plume; tagamite of bottom flows. Although the lowermost part of the section is not exposed by boreholes, the same tagamite comprising megablocks of target crystalline rocks being assumed there.

Within the annular depression, the impact sequence is exposed in full; it reaches up to 2 km thick, from top to bottom: (a) base surge suevite; (b) pyroclastic flow facies – coarse suevite comprising irregularly-shaped tagamite bodies; (c) thick tagamite sheet (ballistic ejecta). The latter overlies various kinds of allogenic lithic breccia that thin out successively outward: crystalline megabreccia cemented by tagamite; mixed crystalline and sedimentary megabreccia cemented by suevite; polymict breccia cemented by fine-grained breccia. All these are composite facial varieties including materials from both ballistic ejecta and, to a lesser extent, crater-forming flowage.

Outside the crater, the same facies sequence occurs but the thickness of impact deposits does not exceed some hundreds of meters there.

Thus, different impact facies take certain structural positions in the Popigai crater – both in outward direction and in vertical section. Distribution of microlithotypes inside and outside the final crater is guided by energy of impact cratering and target properties.

Concluding remarks. Analysis of impact facies is of great importance for so-called “suevite conundrum” [10, 11]. It is obvious that ‘suevite” is a lithological term based on observed textural features. However, the facial variability of impact deposits causes the variety of suevite types, which can differ considerably one from another. Various suevite species are generated by different processes contributing variably in dependence on cratering parameters and target properties. Thus, any model suggested for a certain suevite deposit is not to be universal. For example, the FCI model [12] is not applicable for any type of suevites from the Popigai crater.

References: [1] Melosh H. J. (1989) *Impact cratering – a geologic process*, 245 p. [2] Masaitis V. L., ed. (1983) *Textures and structures of explosion breccias and impactites*, 159 p. (in Russian). [3] Raichlin A. I. et al. (1980) *LPS XI*, 911-913. [4] Stöffler D. and Grieve R. A. F. (2007), in *Metamorphic rocks*, Pergamon, 72-82. [5] Fisher R. V and Schminke H.-U. (1984) *Pyroclastic rocks*. 472 p. [6] Vishnevsky S. A. (1981) in: *Impactites* Moscow Univ. Press, 157-180 (in Russian). [7] Masaitis V. L (2003) in *Impact markers in the stratigraphic record*, Springer, 137-162. [8] Feldman V. I. (1990) *Petrology of impactites* (in Russian). Moscow University Press. 299 p. [9] Masaitis V. L et al. (1998) *Diamond-bearing impactites of Popigai astrobleme,* 178 p. (in Russian). [10] Grieve R.A.F. et al. (2010*) Meteoritics & Planetary Sci., 45*, 559-572. [11] Stöffler D. et al. (2013) *Meteoritics & Planetary Sci., 48*, 515-589. [12] Artemieva N. A et al. (2013) *Meteoritics & Planetary Sci., 48*, 590-628.